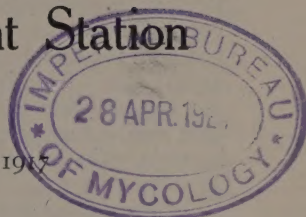


PURDUE UNIVERSITY

Agricultural Experiment Station

CIRCULAR No. 71
LAFAYETTE, IND., SEPTEMBER, 1917



POTATO DISEASES IN INDIANA

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While potatoes can not be considered one of the most important agricultural crops in Indiana, there is in the aggregate a considerable farm acreage planted to this crop annually in the State. In addition to those planted on the farms, potatoes are included in nearly every home garden. The average yield per acre in the State is very low. The cause of this low yield is in part due to the effect of plant diseases and insect pests. It is the purpose of this circular to give in condensed form an account of the more important diseases of the potato which are known to occur in the State, with suggestions for their control. Some other troubles of minor importance are known to occur in Indiana which are not mentioned in the circular. Additional information regarding the potato diseases covered in the following pages, or of others not included, will be gladly furnished to Indiana growers at any time. Address the Department of Botany, Purdue University Agricultural Experiment Station, LaFayette, Ind. When making inquiries regarding plant diseases, it is always desirable to send specimens for examination. These should be carefully selected, and if the trouble is a leaf disease, should include the whole top. They should be so wrapped as not to dry out during transit.

LATE BLIGHT

The disease known as late blight, or often simply as "blight," is, in the northern potato district of the United States, the most serious and destructive of any known to attack this crop. In Indiana, however, the disease is not common; in fact, rarely develops seriously. In seasons when abundant warm rains occur throughout the summer, the trouble may be expected to occur in the northern countries. The condition referred to as "blight" by the growers will usually be found on investigation to be due to tip burn, *Rhizoctonia* or the *Fusarium* wilt, discussed elsewhere in this circular. The grower should learn to distinguish carefully between the different diseases.

SYMPTOMS.—Late blight is usually first noticed on the leaves as dark, water-soaked areas which enlarge very rapidly, often involving the entire leaf in three or four days. A white mildew appears on the under surface of the diseased areas, presenting a frosty appearance. This is especially noticeable when the diseased leaves are wet and during the time when the disease is spreading rapidly. The entire tops are finally killed and other organisms, especially bacteria, gain entrance to the rotting tissues and bring about a foul smelling soft rot.

Infection of the tuber also results in a characteristic rot. This first appears as discolored areas, that gradually become somewhat sunken and dry. When the infection on the leaves occurs early in the season, the tubers may show considerable rot at digging time; if, however, the foliage infection comes late, there may be no indication of rot until after the tubers are stored. The affected tubers may show the rot only in small areas or the whole surface may be involved. The rot usually extends only about one-fourth inch into the flesh, which becomes a reddish-brown color. If wet weather prevails at digging time, bacteria and other fungi may enter through the spots produced by the late blight and cause a soft or wet rot.

CAUSE.—The late blight is caused by a fungus¹ which is introduced into the fields through infected seed tubers. When diseased seed is planted the fungus may spread from the seed piece to above the surface of the ground, where spores are produced on the stem in abundance. From this source, the spores are blown by the wind to surrounding plants in the same field, or to plants in other fields in the vicinity, and start the infection on the leaves. The tubers are infected from spores which fall to the ground from the affected leaves above.

Control.—Tubers which show the dry rot or which were dug from a field known to have been blighted should not be used for seed. Seed treatment, however, is of no value as a control measure.

Spraying with Bordeaux mixture 5-5-50 will control the disease. Five to seven applications should be applied, depending on the prevailing weather conditions. The first application should be made when the plants are six to eight inches high, and subsequent applications made sufficient to keep the new foliage protected. Spray just before rainy periods. Such periods are forecasted by the Weather Bureau.

Lime-sulfur can not be used in place of Bordeaux in potato spraying. It has been shown conclusively that lime-sulfur not only fails to control disease on potatoes, but results in serious injury to the plant.

As a protection against flea beetles and the Colorado potato beetle, one-half pound of Paris green may be added to each

¹ *Phytophthora infestans*

50 gallons of the Bordeaux mixture, or if preferred, three pounds of arsenate of lead or one quart of arsenite of soda may be used to each 50 gallons of spray.

The grower should be cautioned against planning a spraying campaign for the late blight unless he is sure that this disease is likely to appear in his district. While it has been conclusively shown in New York state and elsewhere, that spraying with Bordeaux mixture will increase the yield sufficiently to more than pay the cost of spraying and materials at normal prices, even in years when the blight does not appear, this has not been demonstrated under Indiana conditions. Until this is demonstrated, spraying is not recommended as a general practice in Indiana unless other diseases, controllable by spraying, are known to develop with sufficient seriousness to warrant the practice. Growers who are interested in experimenting with spraying for potatoes are invited to communicate with the Department of Botany, Purdue University Agricultural Experiment Station.

EARLY BLIGHT

This disease is quite common in potato fields throughout this state. Owing to the fact that the injury is confined to the leaves, it is difficult to make an accurate estimate of the loss due to this disease. However, it is certain that, in some Indiana potato fields during the past season, the yield of marketable tubers was decreased appreciably as a result of this disease. The damage resulting depends on weather conditions as well as on the varieties grown. In seasons in which frequent rains occur, especially when the leaves remain moist for several hours at a time, heavy infection may be expected. Although considerable variation has been observed in the susceptibility of different varieties to infection, no variety has been found that is wholly resistant. The disease may occur throughout the season, although injury usually begins before late blight makes its appearance.

SYMPTOMS.—This disease appears on the leaves as circular or irregular, brown spots, varying in size from one-fourth to one-half inch or more. These spots may unite, resulting in the death of large areas of the leaf. When this occurs near the margin of the leaf, a rolling of the edge, somewhat resembling tip burn, may result. Each spot shows a series of concentric or "target-board" rings which apparently mark the successive advances of the fungus in the tissues of the leaf. This concentric zonation of the spots serves to distinguish this disease readily from the spots caused by late blight. After heavy rains, the centers of these spots are sometimes found to have dropped out. While the stems and tubers are not directly attacked by this disease, the injury may result in the early death of the foliage, and a premature ripening of the vines. When this occurs the yield of tubers may be materially decreased.



Fig. 1. Potato leaf affected with early blight. Note the "target board" spots

CAUSE.—This disease is caused by a fungus¹ which reproduces itself by means of spores which are formed on the surface of the leaf. These may be scattered by wind, rain or insects to other parts of the same plant or to neighboring plants, where, under favorable moisture conditions they germinate, sending out several germ tubes which penetrate into the tissues of the leaf and form new spots. After growing through the leaf tissues for some time, stalks which bear another crop of spores are sent to the surface of the leaf and the life cycle of the fungus is repeated. The disease is more frequently associated with insect injuries or some other weakened condition of the leaf, although it has been shown that the fungus may attack perfectly healthy normal leaves.

Control.—The early blight may be controlled by spraying with Bordeaux mixture 5-5-50 as recommended for late blight on page 2.

¹ *Alternaria Solani*

TIP BURN

This disease is quite commonly mistaken for late blight. It is characterized by the death of the leaves at the tips and margins. The diseased portions dry out, blacken and roll up or break off. Tip burn is frequently associated with early blight, from which it may be distinguished by the absence of the concentric rings. It may be distinguished from late blight by the uprolled margin.

This disease is not caused by a parasite but is due to unfavorable conditions of growth among which is excessive evaporation of moisture. It is most prevalent in hot, dry weather, following favorable conditions for growth, and is especially severe where potatoes are grown on light soils.



Fig. 2. Potato leaf showing the effects of tip burn. Note the shrivelled tips and margins

Control.—This disease may be considerably lessened by good cultural practices which tend to maintain a uniform moisture supply throughout the growing season, and by spraying with Bordeaux mixture, 5-5-50, as for late blight.

RHIZOCTONIA

The Rhizoctonia disease of potatoes is assuming considerable importance in potato fields throughout this state. The loss due to this trouble is usually not appreciated by the grower, since in most cases the trouble is attributed to dry weather, insect injury or natural maturity of the vines. During the past season losses caused from the stem rot phase of the disease were very heavy, especially among the early planted varieties. Weather conditions play a very important part in the progress of this disease, the early wet weather

of the past season having been especially favorable for the development of stem rot. In a garden near LaFayette, Ind., a severe outbreak of the disease appeared and 100 per cent. of the plants were affected with Rhizoctonia. In this garden, the original stand was fairly good, the injury not having become severe until after the plants were well up.

SYMPTOMS.—This disease attacks both vines and tubers, the symptoms of the trouble varying greatly under different environmental conditions. The disease appears on the young shoots as brownish lesions below the surface of the soil. In severe attacks the shoots may be entirely killed either before or after reaching the surface of the soil, thus resulting in a poor stand. These brownish lesions may also occur on the older stems. They may be confined largely to the surface of the stem or may be somewhat sunken, in severe cases completely girdling the stem and resulting in the formation of bushy vines bearing a number of aerial tubers. In some instances, numerous small potatoes may be produced around the stem near the ground line. In case the stolons are attacked, an abnormal number of little potatoes may result. Diseased plants may frequently be recognized by the light green foliage

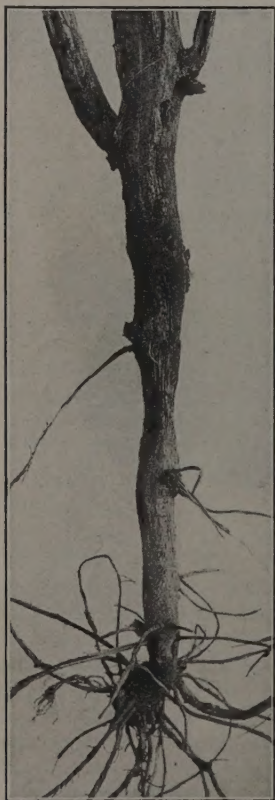


Fig. 3. Stems affected with Rhizoctonia. Note the constriction of the stem and the black lesions

and the stunted appearance of the vines. During wet weather, a white powdery growth may appear on the surface of the lower part of the stem and leaves.

On the tubers dark brown or black bodies known as sclerotia, are produced. These are firmly attached to the skin of the tuber and do not readily wash off. (Fig. 4) They are extremely common, scarcely a single lot of tubers being entirely free from them. Sometimes a russet scab and cracking of the tuber occurs and under certain conditions more or less pitting of the tuber may result.

CAUSE.—This disease is caused by a fungous organism¹ which may live over winter on decaying vegetable matter in the soil or as sclerotia on the surface of the potato tubers. These sclerotia are

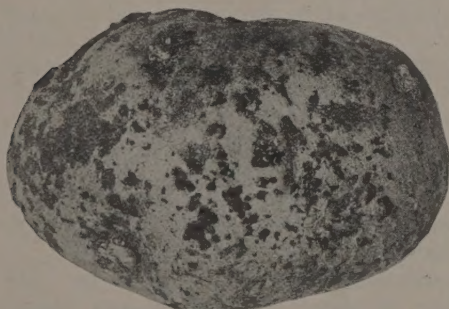


Fig. 4. Rhizoctonia on the tubers. Note the black bodies on the surface. These are the sclerotia

made up of dense masses of fungous threads or hyphæ. When the diseased tubers are planted, these threads start growth, spread into the adjacent soil and attack the stems and later the stolons of the potato plant. During wet weather, the fungus may appear as a white, powdery growth on the surface of the stem just above ground.

Here an immense number of reproductive bodies known as spores are produced and are scattered about the field by wind or insects.

Control.—A system of crop rotation in which potatoes are included only every fourth or fifth year should be practiced. Another vegetable crop should preferably not be included in the rotation. A system by which potatoes follow clover or other leguminous crop is perhaps best.

Only clean, smooth tubers should be selected for seed. Special care should be used to avoid those which show the black sclerotia described above.

The seed tubers should be soaked in corrosive sublimate as discussed on page 16. The formaldehyde treatment is not as effective.

BLACK LEG

This important disease attacks both vines and tubers, and is not uncommon in Indiana. The prevalence of the disease is greatly influenced by weather conditions. Rainy weather in the early part of the growing season is especially favorable for its development.

¹ Corticium vagum

SYMPTOMS.—Affected plants usually show signs of the disease when they are six to eight inches high and when growing rapidly. They appear somewhat unthrifty and often undersized. The branches and leaves have a tendency to grow upward instead of spreading out in the usual way. This condition is also frequently accompanied by a curling of the leaves. In later stages of the disease, the foliage becomes light green and the plant gradually turns yellow and dies. Frequently, if the disease progresses rapidly, the plant may fall over suddenly and wilt. If plants suspected of being attacked are pulled up, or if those which have wilted as a result of this disease are closely examined, the base of the stem below the ground will be found to be characteristically blackened. It is from this character that the disease takes its name. Usually the stem is blackened for two or three inches above the ground and occasionally for a considerably greater distance. The tissue of the stem is found to show a soft, wet decay. As a rule, the seed piece from which affected plants have developed is found to be entirely decayed by a soft rot.

On the tubers, the disease produces a black, soft rot. This condition may occur either in the field or in storage.

CAUSE.—Black leg is caused by bacteria.¹ The germs are carried in the seed potatoes, especially those which are cracked or bruised. They do not live over from year to year in the soil.

Control.—Only clean, sound tubers should be used for seed. When sorting seed potatoes, all those which show any cracks, bruises or rots, should be rejected.

All seed should be disinfected before cutting, by the use of corrosive sublimate or formaldehyde as recommended on page 15. When cutting the seed, a thin slice should first be removed from the stem end and those which show any discoloration in the tissue should be discarded. As a special precaution, it has been recommended that when cutting, extra knives and a jar of formaldehyde be provided, and if by chance a diseased tuber is cut into, the knife blade should be placed in the disinfecting solution for some time and another used in its place. It is important that the seed should not be cut until just before planting and every precaution should be taken to prevent contamination after treatment.

FUSARIUM WILT

This disease is quite generally distributed throughout the State and losses from this source often assume considerable proportions. A wilt of the top is produced and often a storage rot follows. The disease is introduced through affected seed tubers.

SYMPTOMS.—The diagnostic characters of Fusarium wilt in the field are a rolling and wilting of the leaves during the warm

¹ *Bacillus phytophthorus*

part of the day, followed by yellowing of the leaves and premature death of the vines. The absence of blackening of the stem serves to distinguish this trouble from black leg. The disease usually appears from four to six weeks before the crop should mature, but in severe cases may appear earlier, even causing defective germination in some instances.

If the lower portion of the stem of a diseased plant is cut across, a brownish discoloration in the sap tubes may be observed. This discoloration extends throughout the underground parts of the stems and for a few inches above ground. The disease appears in the tuber as a more or less complete brown ring near the stem end. In some cases infected tubers develop a rot in storage.

CAUSE.—This disease is caused by a fungus¹ which is believed to gain entrance from the soil through the smaller roots, from which it grows into the main stem, plugging up the water-conducting vessels and thus causing wilting. The fungus then grows through the stolons into the tubers, giving rise to the brown ring at the stem end. It overwinters in the tubers or in infected soil.

Control.—The following control measures are recommended.

1. *Roguing.* Where home-grown seed is used the field should be gone over in late summer, but before the vines have died, and all diseased hills removed. In case the disease is abundant, new seed stock should be obtained.
2. *Seed selection at planting time.* A thin slice should be cut from the stem end of the tubers and all tubers showing the ring discoloration should be discarded. If the tubers are cut lengthwise, any which show brown streaks extending inward from the stem end should be discarded.
3. *Crop rotation.* A crop rotation in which potatoes or tomatoes do not occur on the same soil for three or four years should be practiced. If the disease has been serious even a longer rotation should be adopted.

COMMON SCAB

Scab is one of the most common and widespread, and perhaps, best known by growers, of the several diseases which attack the potato tuber. Losses due to this disease are often very large. Badly diseased tubers are unmarketable, and when only slightly affected do not command as high a price as clean, smooth potatoes, and are more subject to rot in storage than healthy ones.

The disease is more severe on alkaline or sweet soil. Scab is said also to attack beets, turnips and some other cultivated crops.

SYMPTOMS.—The disease causes rough, scabby spots or pits on the tubers. These vary from small or large, more or less superficial, corky spots to deep pits. They may be scattered irregularly over the tubers (Fig. 5) or in cases of severe infection the greater

¹*Fusarium oxysporum*

part of the surface may be involved. Often the disease takes the form of irregular furrows having a corky lining. The pitted condition is in part due to the work of insects, especially mites, which enlarge the scab spots.

CAUSE.—Scab is caused by an organism¹ belonging among the higher bacteria. The organism is carried over from season to season on the seed potatoes in the scabby spots or in the dust on the surface of smooth tubers. It is also claimed that the healthy tubers may become infected if kept in a bin with diseased ones or where placed in sacks that have contained diseased tubers. Scab may be carried in manure from animals that have been fed scabby po-



Fig. 5. Potato tubers affected with common scab

tatoes, as it has been shown that the organisms are able to pass through the digestive tract without injury. When once introduced, the scab organism may live over in the soil for an indefinite period.

Control.—Soil which is free from the parasite should be used for potatoes. New land, or land on which potatoes have not been grown for a period of four years, is usually satisfactory. A system of rotation in which potatoes are planted following clover is best. The application of lime, carbonate of potash, stable manure or wood ashes just previous to planting, should be avoided. Scabby potatoes should not be fed to stock unless they are previously cooked and should not be thrown on the manure heap. Select for seed, tubers which are free from scab or other diseases as far as possible. All seed whether apparently healthy or known to be affected with scab should be treated either with corrosive sublimate

¹ *Actinomyces chromogenus*

or formaldehyde, according to the directions given on page 15. *The treatment will not be successful, however, unless the seed is planted on land free from the parasite.*

SILVER SCURF

This disease of the tubers is not usually very serious but is of wide distribution in this country and is known to occur in Indiana. The disease attacks the skin of the potato and a rapid loss of moisture occurs which finally results in a shrivelled condition, which impairs the market value of the tubers.

SYMPTOMS.—At first the disease appears as dark patches on the tuber, which often cover considerable areas. The surface of these spots, when clean, presents a silvery appearance, hence the common name. When examined closely, the affected areas are found to be spotted with minute, black specks, especially in the more advanced stages of the disease. Later the spots increase in size and gradually become depressed, finally resulting in more or less wrinkling and shrivelling of the whole tuber.

CAUSE.—The cause of this disease is a fungus¹ which develops in the outer cells of the skin and soon forms a mold-like growth which consists largely of upright stalks on which spores are formed. Later, black masses of fungous tissue develop in the outer cells of the diseased skin. As the disease progresses, the outer layers of affected skin may sluff off, along with some of the black masses of fungous tissue and thus infect the soil.

Control.—Efforts to control this disease by soaking the seed tubers in corrosive sublimate or formaldehyde have not been uniformly successful, and it is doubtful if the trouble can be controlled in this way. Potatoes affected with this fungus should not be used for seed. If care is exercised in this regard, and a four or five year rotation is practiced, the disease will probably not develop to any appreciable extent.

OTHER TUBER DISEASES

In addition to the rots produced by the organisms causing late blight, black leg and Fusarium wilt, other fungi and bacteria are often found associated with the rotting of tubers, particularly after they are stored. Much of this trouble is due to infection through wounds and bruises, by various bacteria and fungi not ordinarily considered parasitic. In addition, however, there are certain distinct types of rots due to specific fungi as well as other troubles not known to be caused by any organism.

Among those due to specific organisms are several distinct rots due to species of Fusarium, organisms closely related to that

¹ *Spondylocladium atrovirens*

which causes the wilt previously discussed. Of those for which no definite cause is known, may be mentioned the troubles known as "internal brown spot," "net necrosis" and "hollow potato," all of which are believed to be related to unfavorable weather and soil conditions.

In general, it may be stated that the only methods of control which may be suggested for these troubles are included in the general recommendations for rotation, seed selection and disinfection discussed on pages 13 to 15.

LEAF ROLL

Leaf roll has been observed to cause more or less damage in several potato fields in this state during the past season. As indicated by the name, the most marked characteristic of leaf roll is an upward rolling of the leaves on the midrib. This rolling may be restricted to the upper leaves or in severe cases, it may occur throughout the entire plant. The color of the foliage varies from light green to yellowish, often with a reddish or purplish tinge. While the disease may appear early in the season, the plants do not die as quickly as they do when attacked by *Fusarium* wilt. Long endurance of the seed piece is another common occurrence with this disease. Affected plants are stunted in growth and the yield of tubers is greatly reduced. Often no potatoes are set or only a few small ones clustered about the stem develop. Aerial tubers are often produced. There is no way of detecting the disease in the tubers when they are removed from the vines. True leaf roll should not be confused with leaf rolling due to black leg, *Rhizoctonia* or *Fusarium* wilt.

CAUSE.—The cause of leaf roll is unknown, but it is not believed to be due to any parasitic organism. The disease may be transmitted from year to year through diseased seed stock but does not spread from diseased to healthy plants in the field.

Control.—Since the disease is transmitted only through diseased tubers, the most important method of control is the selection of seed from disease-free stock. The field should be gone over during the growing season and all hills showing signs of the disease should be dug. In case a considerable number of diseased hills are present, seed should be obtained from a field in which no disease was present.

CURLY DWARF

Plants affected by curly dwarf are characterized by a dwarfed development of the vine accompanied by a pronounced downward curling and wrinkling of the foliage which remains normal in color. The stem branches, leaf petioles and veins are shorter than normal, giving the plant a bushy appearance. This appearance may be

further increased by the formation of short, secondary branches. Diseased plants produce only a few small tubers or none at all.

Curly dwarf, like leaf roll, is supposed to be due to some physiological cause and, like leaf roll, it is transmitted through the seed. While this disease has not yet been observed in potato fields in Indiana, it doubtless occurs and is described here so that growers may be on the watch for it. It is controlled in the same manner as leaf roll.

MOSAIC

This disease causes a dwarfing of the plant accompanied by a characteristic mottling and wrinkling of the leaves, yellowish or light green areas alternating with the normal green. The yield of tubers may be considerably reduced.

The cause of the disease is unknown but it has been shown that it may be transmitted through tubers taken from diseased vines.

Mosaic has not been observed to be common in this state, but a few cases were seen during the past season in gardens near LaFayette, Ind.

The only control measure known is the selection of seed from fields in which no mosaic occurs.

GENERAL CONTROL MEASURES

In general it may be said that the adequate control of disease in potatoes is dependent primarily on the application of certain general practices, including particular attention to questions of proper soil management, seed selection and storage, and disinfection of seed.

SOIL MANAGEMENT

The best and most up-to-date methods of culture should be practiced, in order to secure good, uniform growth of the vines. Especially should attention be given to cultivation, in order to insure a uniform and adequate supply of moisture during periods of drouth.

ROTATION.—One of the most important practices having a direct bearing on the control of disease is the system of rotation. It is of little benefit to carefully select and disinfect seed if this is planted on soil that has produced diseased crops. As previously noted, there are several diseases, notably scab, *Rhizoctonia* and *Fusarium* wilt which persist in the soil for a number of years, and should potatoes be grown continuously in the same field, these diseases will increase to such an extent that it will be impossible to grow a profitable crop. On this account a system of rotation in which potatoes are included only every fourth or fifth year should be universally practiced.

FERTILIZATION.—Careful attention should be given to matters of fertilization. Certain precautions are necessary, however, on account of their bearing on scab control. These have been discussed on page 10.

SEED SELECTION

Good seed is the most important factor in the production of a maximum crop of potatoes. It is important, not only that attention be given to selecting seed uniform in size and shape and true to type of the variety planted, but that special attention be given to the matter of disease.

There are several methods of selection available to the grower. The best method is to grow the seed potatoes in a seed plot planted by the tuber-unit method.

Tuber-unit Method.¹—"The tuber-unit method, as now generally understood, consists in selecting from the seed bin before planting time a considerable number of the most perfectly shaped tubers of from six to eight ounces in weight. When planted, these tubers are quartered, as dropped, into four as nearly equal parts as possible. This is done by splitting the bud-eye cluster in each direction from seed to stem end of the tuber. In other words, the tuber is cut through its longitudinal axis. The four pieces of each tuber are dropped consecutively in the row at a distance of from 10 to 12 inches apart in the furrow. All tubers showing discoloration of the flesh or other evidence of disease should be rejected. By allowing an additional spacing between each set of fours, the four plants from each tuber are definitely isolated from adjoining ones and the grower can readily observe any variation in vigor and uniformity between the various units planted. This method also enables him to detect any mixtures that may occur in the variety. All mixtures should at once be removed. By marking those which appear to be most uniform in size, vigor, and type when the plants are still in vigorous growth, the first step in selection has been accomplished. At digging time the product of each unit is separately harvested and a further selection made from the marked units of all those which most nearly approach the size, shape, and smoothness desired. These selected tubers should be numbered with both field and unit numbers and separately placed in small sacks, preferably cotton or burlap, and stored to await further examination. The final examination should consist of notes on the number and weight of merchantable and unmerchantable tubers and their general conformity in size, shape, and smoothness to the type desired. From each of the units retained, 10 of the best tubers should be selected for the next season's planting.

"It is desirable to maintain the study of each selection on the tuber-unit basis the following season, because it permits a more accurate comparison of the behavior of each. The 10 selected tubers from each original unit will give 40 plants for study the second year. All selections which do not produce a reasonably uniform lot of plants should be marked for rejection. At harvest time the progeny of each selection should be kept by itself and the same data recorded as that taken on the crop grown from the original tuber unit. Only the product from such 40 hill rows as meet the most rigid requirements should be retained. The further conduct of the work will consist in the multiplication of the selected strains for field planting and the elimination of weak plants."

If this method is used, special attention should be given to eliminating any selections that show evidence of any of the diseases previously described, which may be carried in the seed.

¹ Stuart, Wm. "Good Seed Potatoes and How to Produce Them." United States Department of Agriculture Farmers' Bulletin No. 533: pp. 1-13; 1913

HILL SELECTION.—This method, while not permanently as effective as the tuber-unit method, has the advantage of being simpler. This method consists in going over the field during the growing season and marking plants which show vigorous growth and freedom from any disease. When the potatoes are dug, only those which show a good yield of tubers of uniform size and free from disease, should be used for seed.

If the progeny of each hill is kept separate, the selections thus made can be planted as discussed under the tuber-unit system the following year.

BIN SELECTION.—If no seed which has been selected by the hill or tuber-unit system is available, then great care must be exercised in selecting the seed from the bin. Only uniform, medium-sized tubers which are free from bruises, cracks or any of the diseases previously discussed should be used.

When the potatoes are cut for planting, a very thin slice should first be cut from the stem end, and any tubers which show any discoloration in the fibers which spread out into the tissue from the stem, should be discarded for seed. If any discoloration is found in any part of the tuber, this should be sufficient grounds for discarding it for seed purposes.

SEED DISINFECTION

The object of disinfection of the seed tubers is to kill any bacteria or fungi that may be on the surface of the tubers selected for seed. It should not be assumed that because the seed looks smooth and free from disease that it does not need disinfection. *All seed potatoes should be disinfected*, no matter from what source they are obtained.

There are two standard methods of seed disinfection, both of which are effective for scab and black leg.

FORMALDEHYDE METHOD.—Soak the seed tubers in one part formaldehyde to 240 parts of water (one pint to 30 gallons). The seed should be soaked for two hours. The same solution may be used repeatedly in treating different lots of seed. It should not, however, be left standing uncovered for any length of time before beginning the treatment. If considerable time elapses between treatments, a new solution should be made up. Either metal or wooden containers may be used.

After treatment care must be taken not to allow the seed to become contaminated again, by placing them in old sacks or crates or in bins that have been used for untreated tubers. All containers used to handle treated seed should be previously sterilized. It is usually recommended to treat the seed before cutting and this should be done if the seed potatoes are not to be planted immediately. In any case it is preferable not to cut the seed until just before plant-

ing. If the seed is to be planted on the same day that the treatment is given, it may be cut before treating. This is especially advantageous if the black leg is suspected of having been present among the potatoes from which the seed was selected. Care should be exercised, however, to be sure that the solution is not any stronger than recommended and that the seed is not left to soak more than two hours. If this precaution is not taken, there is danger of injury to the eyes. Potatoes treated by the formaldehyde method may be used for food or for stock, if thoroughly washed.

CORROSIVE SUBLIMATE METHOD.—Soak the seed tubers for one and one-half hours in a solution of one part corrosive sublimate to 1,000 parts of water (four ounces to 30 gallons). This method is more expensive than the formaldehyde method and also somewhat more troublesome. Corrosive sublimate is a violent poison when taken internally and must be carefully guarded. It is not, however, injurious to the skin, so it may be handled without danger. Metal containers must not be used in the operation of handling the solution as the chemical reacts with metals with the result that the strength of the solution is gradually weakened. Potatoes which have been treated with this solution should not be eaten or fed to stock.

This method is entirely effective for scab and black leg, and has the advantage of being more effective for *Rhizoctonia* than the formaldehyde. If the latter disease is known to be present, it would be advisable to use this method in preference to the formaldehyde.